

Claims

[c1] What is claimed is:

1. An element for use in an inductive coupler in a down-hole tool, comprising:

a plurality of ductile, generally U-shaped electrically conductive leaves, each leaf separated from the otherwise adjacent leaves by electrically insulating material, wherein said leaves are less than about .0625" thick and said leaves are aligned to form a generally circular trough.

[c2] 2. The element of claim 1 wherein the initial relative magnetic permeability of the element is between about 650 and about 5,000.

[c3] 3. The element of claim 1 wherein the maximum relative magnetic permeability of the element is between about 2000 and about 800,000.

[c4] 4. The element of claim 1 wherein the generally U-shaped electrically conductive leaves are less than about .030" thick.

[c5] 5. The element of claim 1 wherein the generally U-shaped electrically conductive leaves are about .014"

thick.

- [c6] 6.The element of claim 1 wherein the conductive leaves comprise a material selected from the group consisting of soft magnetic alloys and semi-hard magnetic alloys.
- [c7] 7.The element of claim 1 wherein the conductive leaves comprise a material selected from the group consisting of Ni, Fe, Cu, Mo, Co, Cr, V, C, Si, as well as alloys and combinations thereof.
- [c8] 8.The element of claim 1 wherein the conductive leaves comprise a mu metal material.
- [c9] 9.The element of claim 1 wherein the conductive leaves comprise a supermalloy material.
- [c10] 10.The element of claim 1 wherein the electrically insulating material is less than .0005"thick.
- [c11] 11.The element of claim 1 wherein the electrically insulating material is selected from the group consisting of epoxies, silicones, polyurethanes and combinations thereof.
- [c12] 12.An inductive coupler for use in downhole components, comprising:
 - an annular housing defining a recess;
 - an MCEI element comprising a plurality of segments dis-

posed within the recess, each segment comprising a plurality of ductile, generally U-shaped electrically conductive leaves, each leaf separated from the otherwise adjacent leaves by electrically insulating material, wherein said leaves are less than about .0625" thick and wherein said leaves and segments are aligned in the recess to form a generally circular trough;
an insulated electrical conductor disposed within the generally circular trough;
a polymer filling spaces between otherwise adjacent segments, the housing and the insulated conductor, and further filling the circular trough.

[c13] 13. The inductive coupler of claim 12 adapted to be operated within the frequency range of 1 Hz to 10 Mhz.

[c14] 14. The inductive coupler of claim 12 wherein the polymer is a thermoset material.

[c15] 15. The inductive coupler of claim 12 wherein the polymer is selected from the group consisting of silicones, epoxies, and polyurethanes.

[c16] 16. The inductive coupler of claim 12 wherein the polymer is a thermoplastic material.

[c17] 17. The inductive coupler of claim 12 wherein the polymer is selected from the group consisting of nylons,

polyethylene, polypropylene, polystyrene, fluoropolymers, polyether ether ketones, polyether ketone ketones, and copolymers of the same.

[c18] 18. The inductive coupler of claim 12 wherein the polymer is a fluoropolymer selected from the group consisting of PFA, FEP, ETFE, AF, PTFE, and ECTFE.